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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/892,332	06/26/2001	Ching-Wei Chang	TAL/7146.119	1906

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EXAMINER	
THOMPSON, JAMES A	
ART UNIT	PAPER NUMBER
2625	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/06/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	09/892,332	CHANG, CHING-WEI	
	Examiner	Art Unit	
	James A. Thompson	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 November 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 09 November 2006 has been entered.

Response to Arguments

2. Applicant's arguments, see Section I on page 7, line 6 to page 11, line 2, filed 09 November 2006 with respect to the rejections of claims 20 and 22 under 35 USC §102(b) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, new grounds of rejection are made in view of newly discovered prior art. Accordingly, new prior art rejections are set forth in detail below.

3. Applicant's arguments, see Section IIa on page 11, line 4 to page 16, line 12, filed 09 November 2006 with respect to the rejections of claims 1-19 and 21 under 35 USC §103(a) have been fully considered by Examiner. Examiner appreciates Applicant detailing various types of halftoning error used in halftoning systems. Examiner agrees with Applicant's overall analyses, but notes that "accumulated error" can be understood more broadly than in the conventional sense presented by Applicant. Further, Examiner respectfully reminds Applicant that, during the course of patent examination, claims are given their broadest reasonable interpretation consistent with the specification [see MPEP §2111].

Examiner also agrees that the present clarifying amendments distinguish the present claims over the cited prior art references. Finally, given that Applicant's arguments are convincing and the present amendments help to distinguish the claims over the prior art relied upon in previous office actions, the rejections have been withdrawn. However, upon further consideration, new grounds of rejection are made in view of newly discovered prior art. Accordingly, new prior art rejections are set forth in detail below.

4. Applicant's arguments, see Section IIb on page 16, line 13 to page 25, line 18, filed 09 November 2006 with respect to the rejections of claims 1-19 and 21 under 35 USC §103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, new grounds of rejection are made in view of newly discovered prior art. Accordingly, new prior art rejections are set forth in detail below.

5. **Regarding Applicant's arguments on page 25, line 19 to page 26, line 7:** Examiner has found Applicant's arguments, along with the present amendments to the claims, convincing and sufficient to overcome the cited prior art references previously relied upon for prior art rejections. New grounds of rejection, based on newly discovered prior art, are set forth in detail below.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. **Claims 1-4 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.** Claims 1-4 are method steps which occur internally in a computer system. Claims 1-4 do not recite subject matter that produces any concrete, tangible and useful result. Therefore, claims 1-4 are non-statutory.

8. **Claims 20-22 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.** While claims 20-22 appear to be directed to an apparatus, particularly a "halftone encoder", it is clear that said halftone encoder is merely software and does not generate a concrete, useful and tangible result. For example, on page 5, line 17 to page 6, line 7 of the specification, a personal computer is described as the means by which the halftone encoding is performed. No equivalent hardware is disclosed in the present specification. Thus, the "selected thresholding unit" and "threshold selection unit" recited in claim 20, the "initial thresholding unit" recited in claim 21, and the "error filter" recited in claim 22 are all elements of a software program. Additionally, the "error buffer" recited in claim 22 is clearly a portion of computer memory set aside for the appropriate data, and is thus merely a data structure set forth in software *as per* one of the many usual software formats that allow for the storage of data (e.g., variable, array, record). Software *per se* is not statutory. Additionally, the elements recited in claims 20-22 merely perform internal operations within a computer. There is no

concrete, tangible and useful result generated. The only results are internally generated data results. Thus, claims 20-22 are non-statutory.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. **Claims 21-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.** Claims 21 and 22 each recite "apparatus of claim 20". However, claim 20 is recited as a "halftone encoder". Thus, claims 21 and 22 are indefinite since said claims refer to an apparatus and not the encoder of claim 20.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claim 20 is rejected under 35 U.S.C. 102(b) as being anticipated by Smith (US Patent 5,633,729).

Regarding claim 20: Smith discloses a halftoning encoder (figures 2-3; and column 7, lines 46-49 and lines 59-61 of Smith) providing respective accumulated errors subject to recalculation pixel-by-pixel (column 7, lines 33-45 and column 9, lines 16-32 of Smith), said encoder comprising:

- (a) a selected thresholding unit (figure 2(201) of Smith) comparing an input density of a current pixel to a selected threshold intensity (column 7, lines 50-58 of Smith).
- (b) a threshold selection unit (figure 2(203) of Smith) selecting a predetermined one of a plurality of threshold intensities for said selected threshold unit (column 7, lines 50-58 of Smith) in response to at least one of said accumulated errors of said current pixel and a pixel neighboring said current pixel (figure 9; column 8, lines 59-65; and column 9, lines 16-32 of Smith). The thresholds for each are selected based on accumulated errors of each pixel so as to minimize the total quantization error (figure 9; column 8, lines 59-65; and column 9, lines 16-32 of Smith).

Thus, the threshold of a particular pixel is selected based on the accumulated error for said particular pixel, and based on the error for a neighboring pixel since said accumulated error for said neighboring pixel is included as part of the total quantization error.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 1-18 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith (US Patent 5,633,729) in view of Ostromoukhov (US Patent 6,356,362 B1).

Regarding claim 1: Smith discloses a method of selecting an intensity threshold for an image halftoning system providing respective accumulated errors subject to recalculation pixel-by-pixel (column 7, lines 33-45 and column 9, lines 16-32 of Smith), said method comprising the steps of:

- (a) selecting a predetermined first intensity threshold if either one of a said accumulated errors of a current pixel and a neighboring pixel exceeds a first error threshold error (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).
- (b) selecting a predetermined second intensity threshold if said accumulated error exceeds a second error threshold and said first intensity threshold is not selected (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).
- (c) selecting a predetermined third intensity threshold if neither of said first and said second intensity thresholds are selected (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).

→ A set of thresholds in a threshold matrix are available for selection based on the amount of quantization error. The selection is performed so as to minimize the overall level of quantization error (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith). If the cost function (which corresponds to the "error threshold error") of using a first threshold is too high for a pixel based on the accumulated error of the individual pixel and the total quantization error, a second threshold is used to determine the cost function. In fact, an array of threshold values are used to

determine which value is best. Thus, if there are only three values in the array, then the third threshold is used if neither the first threshold nor the second threshold have a lower cost function.

Smith does not disclose expressly that said second intensity threshold is selected based on a pixel remotely neighboring said current pixel.

Ostromoukhov discloses selecting one of multiple thresholds (figure 7(106) of Ostromoukhov) based on a large neighborhood, which would include at least a pixel remotely neighboring said current pixel (figure 9; column 8, lines 41-44; column 9, lines 9-12; and column 10, line 65 to column 11, line 4 of Ostromoukhov).

Smith and Ostromoukhov are combinable because they are from the same field of endeavor, namely the selection of one of multiple intensity thresholds for halftoning based on the input image data of the local neighborhood of pixels. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a larger neighborhood for selecting threshold values, as taught by Ostromoukhov, said selection performed based on accumulated error, as taught by Smith. Thus, the second intensity threshold is selected based on a pixel remotely neighboring said current pixel. The motivation for doing so would have been to mitigate the effects of printing artifacts that occur as a result of repetitive output (column 2, lines 6-33 of Ostromoukhov). Therefore, it would have been obvious to combine Ostromoukhov with Smith to obtain the invention as specified in claim 1.

Regarding claim 2: Smith discloses that at least one of said first and said second error thresholds is substantially zero (column 8, lines 59-65 of Smith). Since the quantization error is desired to be minimized (column 8, lines 59-65 of Smith), then at least one of said first and said second error thresholds will be substantially zero.

Regarding claim 3: Smith discloses that an intensity of said first intensity threshold is greater than an intensity of said second intensity threshold, and said intensity of said second intensity threshold is greater than an intensity of said third intensity threshold (column 9, lines 45-60 of Smith). The intensity thresholds are sorted in ascending according to error value (column 9, lines 45-60 of Smith). Thus, for large input values, the intensity of said first intensity threshold will be greater than an intensity of said second intensity threshold, and said intensity of said second intensity threshold will be greater than an intensity of said third intensity threshold.

Regarding claim 4: Smith discloses that at least one of said accumulated error of said first pixel, said neighboring pixel, and said remote neighboring pixel (taught by the combination of Smith in view Ostromoukhov) comprises a component color error for said pixel (column 2, lines 54-59 of Smith).

Regarding claim 5: Smith discloses a halftone image display method providing respective accumulated errors subject to recalculation pixel-by-pixel (column 7, lines 33-45 and column 9, lines 16-32 of Smith), said method comprising the steps of:

- (a) determining an intensity of a current pixel in an image (figures 2(202) and column 7, lines 50-53 of Smith).
- (c) selecting a predetermined first intensity threshold if either one of said current said accumulated pixel error and a neighboring said accumulated pixel error is less than an error threshold and otherwise selecting a predetermined second intensity threshold (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).
- (d) displaying said current pixel with one of a first displayed intensity (255) if said augmented intensity of said current pixel exceeds said selected intensity threshold and otherwise displaying said current pixel with a second displayed intensity (0) (column 7, lines 33-37 of Smith).

Smith does not disclose expressly (b) augmenting said intensity of said current pixel with a current said accumulated pixel error; and (e) assigning a said accumulated error between said displayed intensity and said augmented intensity of said current pixel to at least one pixel neighboring said current pixel.

Ostromoukhov discloses:

- (b) augmenting said intensity of said current pixel with a current said accumulated pixel error (column 9, lines 36-38 of Ostromoukhov).
- (e) assigning a said accumulated error between said displayed intensity and said augmented intensity of said current pixel to at least one pixel neighboring said current pixel (column 9, lines 48-56 of Ostromoukhov).

Smith and Ostromoukhov are combinable because they are from the same field of endeavor, namely the selection of one of multiple intensity thresholds for halftoning based on the input image data of the local neighborhood of pixels. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply error diffusion to the system of Smith. The motivation for doing so would have been to enhance edge sharpness and preserve fine image detail while yielding an overall pleasing image (column 1, lines 42-44 of Smith). Therefore, it would have been obvious to combine Ostromoukhov with Smith to obtain the invention as specified in claim 5.

Regarding claim 6: Smith discloses that said error threshold is substantially zero (column 8, lines 59-65 of Smith). Since the quantization error is desired to be minimized (column 8, lines 59-65 of Smith), then at least one of said first, said second, and said third error thresholds will be substantially zero accumulated error.

Regarding claim 7: Smith discloses that said first displayed intensity comprises a maximum intensity (255) and said second displayed intensity comprises a minimum intensity (0) (column 7, lines 33-37 of Smith).

Regarding claim 8: Smith discloses that said intensity of said current pixel comprises an intensity of a color component of said pixel (column 2, lines 54-59 of Smith).

Regarding claim 9: Smith discloses that an intensity of said first intensity threshold is greater than an intensity of said second intensity threshold (column 9, lines 45-60 of Smith). The intensity thresholds are sorted in ascending according to error value (column 9, lines 45-60 of Smith). Thus, for large input values, the intensity of said first intensity threshold will be greater than an intensity of said second intensity threshold.

Regarding claim 10: Smith discloses the step of displaying said current pixel with said first displayed intensity if said augmented intensity of said current pixel exceeds a third intensity threshold (Ly), an intensity of said third intensity threshold being greater than an intensity of said first threshold intensity threshold (0) (column 9, lines 50-58 of Smith).

Regarding claim 11: Smith discloses that at least one of said current said accumulated pixel error and said neighboring accumulated pixel error comprises a component color error (column 2, lines 54-59 of Smith).

Regarding claim 12: Smith discloses a halftone image display method providing respective accumulated errors subject to recalculation pixel-by-pixel (column 7, lines 33-45 and column 9, lines 16-32 of Smith), said method comprising the steps of:

- (a) determining an intensity of a current pixel in an image (figures 2(202) and column 7, lines 50-53 of Smith).
- (c) selecting a predetermined first intensity threshold if either one of said current pixel accumulated error and an immediate neighboring pixel accumulated error is less than a first error threshold (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).
- (d) selecting a predetermined second intensity threshold if at least one of said current pixel accumulated error and an immediate neighboring pixel accumulated error is less than a second

error threshold and said first error threshold is not selected (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).

- (e) selecting a predetermined third intensity threshold if an accumulated error is less than a third error threshold and neither of said first and said second errors threshold are selected (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).
- (f) selecting a fourth intensity threshold if one of said first, said second, and said third intensity thresholds are not selected (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith).

→ Further explanation of (c)-(f): A set of thresholds in a threshold matrix are available for selection based on the amount of quantization error. The selection is performed so as to minimize the overall level of quantization error (figure 10; column 8, lines 59-65; and column 9, lines 16-32 of Smith). If the cost function (which corresponds to the "error threshold error") of using a first threshold is too high for a pixel based on the accumulated error of the individual pixel and the total quantization error, a second threshold is used to determine the cost function. In fact, an array of threshold values are used to determine which value is best. Thus, if there are four threshold values in the array, then the first, second, third or fourth threshold value is used based on whichever one has the lowest cost function. If the first, second and third threshold values are not selected because the fourth threshold value has the lowest cost function, then the fourth threshold value is used.

- (g) displaying said current pixel with one of a first displayed intensity (255) if said augmented intensity of said current pixel exceeds said selected intensity threshold and otherwise displaying said current pixel with a second displayed intensity (0) (column 7, lines 33-37 of Smith).

Smith does not disclose expressly (b) augmenting said intensity of said current pixel with a current pixel accumulated error; that said second intensity threshold is selected based on a pixel remotely neighboring said current pixel; that said third intensity is selected based on a more remote neighboring pixel; and (h) assigning an accumulated error between said displayed intensity and said augmented intensity of said current pixel to at least one pixel neighboring said current pixel.

Ostromoukhov discloses:

- (b) augmenting said intensity of said current pixel with a current pixel accumulated error (column 9, lines 36-38 of Ostromoukhov).
- selecting one of multiple thresholds (figure 7(106) of Ostromoukhov) based on a larger neighborhood, which would include at least a pixel remotely neighboring said current pixel and a

pixel more remotely neighboring said current pixel (figure 9; column 8, lines 41-44; column 9, lines 9-12; and column 10, line 65 to column 11, line 4 of Ostromoukhov).

- (h) assigning an accumulated error between said displayed intensity and said augmented intensity of said current pixel to at least one pixel neighboring said current pixel (column 9. lines 48-56 of Ostromoukhov).

Smith and Ostromoukhov are combinable because they are from the same field of endeavor, namely the selection of one of multiple intensity thresholds for halftoning based on the input image data of the local neighborhood of pixels. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a larger neighborhood for selecting threshold values, as taught by Ostromoukhov, said selection performed based on accumulated error, as taught by Smith. Thus, the second intensity threshold is selected based on a pixel remotely neighboring said current pixel, and the third intensity threshold is selected based on a pixel more remotely neighboring said current pixel. The motivation for doing so would have been to mitigate the effects of printing artifacts that occur as a result of repetitive output (column 2, lines 6-33 of Ostromoukhov). Therefore, it would have been obvious to combine Ostromoukhov with Smith to obtain the invention as specified in claim 12.

Regarding claim 13: Smith discloses that at least one of said first, said second, and said third error thresholds is substantially zero accumulated error (column 8, lines 59-65 of Smith). Since the quantization error is desired to be minimized (column 8, lines 59-65 of Smith), then at least one of said first, said second, and said third error thresholds will be substantially zero accumulated error.

Regarding claim 14: Smith discloses that said first displayed intensity comprises a maximum intensity (255) and said second displayed intensity comprises a minimum intensity (0) for said pixel (column 7, lines 33-37 of Smith).

Regarding claim 15: Smith discloses that said intensity of said current pixel comprises an intensity of a color component of said pixel (column 2, lines 54-59 of Smith).

Regarding claim 16: Smith discloses that an intensity of said first intensity threshold is greater than an intensity of said second intensity threshold, said intensity of said second intensity threshold is greater than an intensity of said third intensity threshold, and said intensity of said third intensity threshold is greater than an intensity of said fourth intensity threshold (column 9, lines 45-60 of Smith). The intensity thresholds are sorted in ascending according to error value (column 9, lines 45-60 of Smith). Thus, for large input values, the intensity of said first intensity threshold will be greater than an intensity of said second intensity threshold, said intensity of said second intensity threshold will be greater than an

intensity of said third intensity threshold, and said intensity of said third intensity threshold will be greater than an intensity of said fourth intensity threshold.

Regarding claim 17: Smith further discloses the step of displaying said current pixel with a maximum displayed intensity if said augmented intensity of said current pixel exceeds a fifth intensity threshold, an intensity of said fifth intensity threshold being greater than an intensity of said first intensity threshold (column 7, lines 50-58 and column 9, lines 45-60 of Smith).

Regarding claim 18: Smith discloses that at least one of said current pixel accumulated error, said neighboring pixel accumulated error, and said remote neighboring pixel accumulated error (taught by the combination of Smith in view Ostromoukhov) comprises a component color error (column 2, lines 54-59 of Smith).

Regarding claim 22: Smith does not disclose expressly (a) an error filter distributing an error produced by printing said current pixel to a plurality of pixels neighboring said current pixel; and (b) an error buffer accumulating said distributed error for a pixel.

Ostromoukhov discloses:

- (a) an error filter distributing an error produced by printing said current pixel to a plurality of pixels neighboring said current pixel (column 9, lines 36-38 of Ostromoukhov).
- (b) an error buffer accumulating said distributed error for a pixel (column 9, lines 48-56 of Ostromoukhov).

Smith and Ostromoukhov are combinable because they are from the same field of endeavor, namely the selection of one of multiple intensity thresholds for halftoning based on the input image data of the local neighborhood of pixels. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply error diffusion to the system of Smith. The motivation for doing so would have been to enhance edge sharpness and preserve fine image detail while yielding an overall pleasing image (column 1, lines 42-44 of Smith). Therefore, it would have been obvious to combine Ostromoukhov with Smith to obtain the invention as specified in claim 22.

14. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith (US Patent 5,633,729) in view of Ostromoukhov (US Patent 6,356,362 B1) and Harrington (US Patent 6,072,591).

Regarding claim 19: Smith in view of Ostromoukhov does not disclose expressly that said component color error comprises an error for a component color other than the component color of the current pixel.

Harrington discloses an error for a component color other than the component color of the current pixel (column 5, lines 27-30 and lines 50-57 of Harrington). By computing sums (column 5, lines 27-30 of Harrington) and differences (column 5, lines 50-57 of Harrington) of the primary color components (CMY), the error is determined for color components that not the component color of said current pixel (column 5, lines 27-30 and lines 50-57 of Harrington).

Smith in view of Ostromoukhov is combinable with Harrington because they are from the same field of endeavor, namely digital image halftoning and error diffusion. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to perform error diffusion for multiple colors using the sum and difference components taught by Harrington for error diffusion. The motivation for doing so would have been to provide for color image processing, which is generally a desirable goal in the digital image processing arts, and using said sum and difference components simplifies error diffusion calculations when there are multiple color components (column 2, lines 61-64 of Harrington). Therefore, it would have been obvious to combine Harrington with Smith in view of Ostromoukhov to obtain the invention as specified in claim 19.

15. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith (US Patent 5,633,729) in view of Zlotnick (US Patent 6,351,566 B1).

Regarding claim 21: Smith does not disclose expressly an initial thresholding unit comparing said input intensity of said current pixel to an initial threshold intensity, said initial threshold being greater than said selected threshold intensity.

Zlotnick discloses an initial thresholding unit (figure 4 (44) of Zlotnick) for comparing said input intensity of said current pixel to an initial threshold intensity (T+D/2) (figure 5(54) and column 8, lines 5-11 of Zlotnick). Since D is clearly a positive number (column 8, lines 5-11 of Zlotnick), said initial threshold intensity (T+D/2) is greater than one of the possible selected intensity thresholds (T). Since the other possibly selected intensity threshold (figure 6("AVERAGE") of Zlotnick) is for use with intermediate values (column 8, lines 8-14 of Zlotnick), said other intensity threshold is less than (T). Therefore, said initial intensity threshold is greater than said selected threshold intensity.

Smith and Zlotnick are combinable because they are from similar problem solving areas, namely selectively halftoning digital image data for pixel value regions including (1) white or near-white, (2) black or near-black, and (3) the gray levels in between. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the initial thresholding unit taught by Zlotnick before the threshold selection unit. The motivation for doing so would have been to be able to determine

initially which category the input image pixel falls into (column 8, lines 8-14 of Zlotnick). Thus, including the initial thresholding unit of Zlotnick into the system taught by Smith would improve the overall image data processing and increase processing efficiency and accuracy by clearly setting forth in advance how the input pixels are to be processed. Therefore, it would have been obvious to combine Zlotnick with Smith to obtain the invention as specified in claim 21.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is 571-272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

29 January 2007

James A. Thompson
Examiner
Technology Division 2625

DAVID MOORE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600